PROJECTA

CONVERTS 24 VOLT DC – 230/240 VOLT AC

POWER INVERTER

POWERS HOUSEHOLD APPLIANCES FROM A 24 VOLT BATTERY

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CONVERTS 24 VOLT DC - 230/240 VOLT AC
2000W POWER INVERTER
POWERS HOUSEHOLD APPLIANCES FROM A 24 VOLT BATTERY
POWER NORMAL FAULT
ON
OUTPUT 230/240V AC 50Hz

P/No.s IM1000-24, IM2000-24

WARNING

- **For use with negatively earthed vehicles & systems only.**
- **For indoor use out of weather only.**
- **Internally bonded for safety, battery DC negative to case & AC socket earth .**
- **Hazardous voltage inside - do not attempt to open or repair.**
- **Do not use if damaged.**
- **Read operating manual before using or making any connections.**
- **Only connect 230/240V AC appliances that are in safe condition.**
- **It is recommended that a type 'A' portable residual current device (RCD) be used for added output protection.**
- **For independent use, do not connect to buildings.**

FEATURES

- Peak Power Technology runs appliances with high start up loads.
- Noise-free filtering reduces TV buzz & interference.
- Built in safety protection against AC power overload and low battery.
- Heavy Duty power leads for direct battery connection.
- Approved AS/NZS power outlet sockets.
- Twin power outlet sockets.
- Temperature controlled automatic cooling fan.

SPECIFICATIONS:

P/No.	**IM1000-24**	**IM2000-24**
Input	24V Battery/Vehicle (20-30 Volt DC)	
Input Current: (Max DC Amps)	60A	120A
Input Standby Current (+/-5%)	400mA	600mA
Output	230/240 Volt AC, 50Hz (Modified Sine Wave)	
Continuous Output Power (Watt)	1000W	2000W
Peak Output Power (Watts)	2000W	4000W
Efficiency	85 - 90%	
Low Battery Alarm/Shutdown	Alarm 21.0 Volt/Shutdown 20.0 Volt (±0.2 Volt)	
Cooling Fan	Automatic temperature controlled	
Thermal Shutdown	65° (±5°C)	
Replacement Fuse	Standard Auto Blade Fuse	
Fuse Quantity & Size	6 x 10A	12 x 10A
Fuse Location	Internal*	Internal*
Connection Cable	$16mm^2$/1100mm	$25mm^2$/1100mm
Dimensions (cm)	24 x 30 x 7.7	20.5 x 29 x 15.5
Weight	3.1kg	4.8kg

* Internal fuses should only be replaced by qualified electrical appliance repairer.

WHAT IS AN INVERTER?

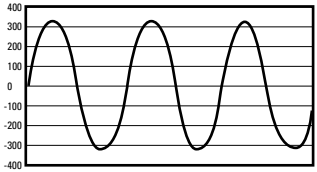
Inverters are designed for powering household appliances from a battery or vehicle. They are electronic devices that convert battery power to (230/240V AC) mains power.

Inverters are compact and often lightweight making them an ideal source of portable mains power. Thanks to their portability they are commonly used in cars, caravans, motor homes, boats, 4WD's, utility vehicles, trucks and buses.

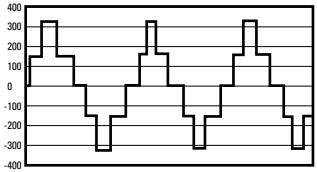
Using an inverter with standard household appliances is a much cheaper option than purchasing specialised 12V or 24V appliances for times when power is not available.

There are two different types of inverters, modified sine wave and true sine wave. The difference between the two is how close the output replicates mains power.

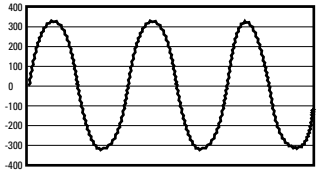
These graphs show the difference in output between mains power, modified sine wave and true sine wave inverters.



MAINS POWER (SINE WAVE)



MODIFIED SINE WAVE



TRUE SINE WAVE

Logically it follows that the process used in a true sine wave inverter is more complex than a modified sine wave inverter and subsequently they are lot more expensive.

In reality most electric appliances operate unaffected on a modified sine wave and hence they are more common.

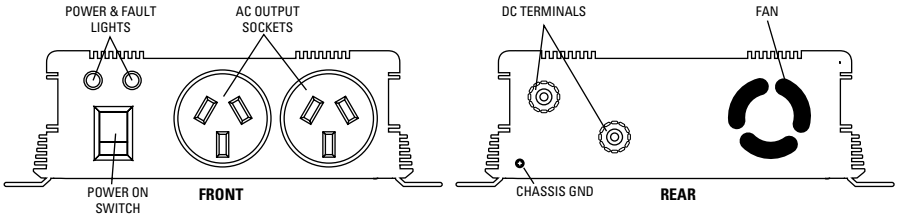
True sine wave inverters are reserved for use on medical equipment and sensitive electrical appliances.

Inverters are available with different power output levels to suit the type of appliances to be powered. Small inverters are designed for powering one small low power electrical or electronic appliance. Larger inverters can be used to power multiple small appliances or one larger appliance. Typically inverters are not an efficient method for running appliances with very high power requirements such as electric heaters, stoves, kettles and air conditioners. This is due to their high current draw and battery consumption.

CONNECTIONS / CONTROLS & ACCESSORIES

After unpacking your inverter take a moment to check that you have all the correct accessories for your model and familiarise yourself with the connections and controls.

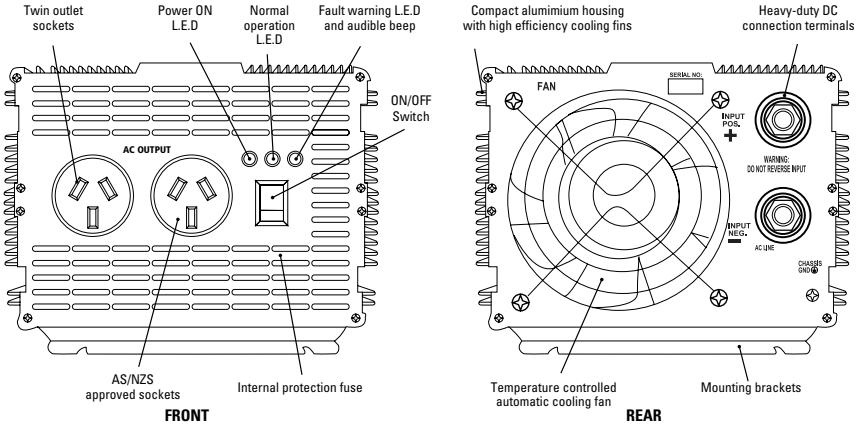
P/No. IM1000-24



Supplied:

- Operating instructions
- Negative (Black) DC connection lead fitted with ring terminal (1100mm)
- Positive (Red) DC connection lead fitted with ring terminal (1100mm)

P/No. IM2000-24



Supplied:

- Operating instructions
- Negative (Black) DC connection lead fitted with ring terminal (1100mm)
- Positive (Red) DC connection lead fitted with ring terminal (1100mm)

PLACEMENT / LOCATION / MOUNTING OF INVERTER

Caution:

- *The inverter must be mounted away from any flammable goods, gas bottles or gas appliances.*
- *Batteries should be mounted in a separate well-vented enclosure.*
- *For vehicle or camping use the inverter must be protected from rain, water or moisture.*

Projecta inverters are designed for indoor, out of weather use only. For best performance the inverter must be used or mounted in a cool, dry, clean and well-ventilated area.

For best TV / Radio reception keep inverter as far away from TV's, radios, antenna cables and antennas as possible.

All models are supplied with mounting brackets if used in mobile applications such as 4WD, Caravan, Motor home or boat the inverter should be mounted to a suitable horizontal or vertical panel, with a least 20cm clearance from the rear panel of the inverter to provide good ventilation for the cooling fan.

SUITABLE POWER SOURCE:

In order to operate the inverter and supply power to an appliance a suitable 24V DC power supply is required. This can be vehicle or caravan batteries, portable power pack or 2 independent 12V batteries joined in series to produce 24VDC. For most applications, deep cycle batteries are recommended for best performance.

The size of the batteries used will determine how long the inverter will supply power to an appliance and how well the inverter will perform. Most batteries are marked with their size in Amp hours (Ah) or Cold Cranking Amps (CCA).

Because inverters are capable of drawing high currents the inverter should only be connected to suitable size batteries. Connection to undersized batteries could damage the batteries and will result in the inverter shutting down within a short period due to low battery voltage.

The amount of power drawn from the batteries is proportional to the inverter load.

P/No.	**IM1000-24**	**IM2000-24**
Minimum Recommended Battery Size	40Ah (350CCA)	50Ah (400CCA)
Run time with maximum load & minium battery size	15min	5min
Run time for a 100 Watt globe with minimum battery size	6 hours	7 hours
Ideal battery size	40-130Ah	50-200Ah

CONNECTION TO POWER SOURCE & EARTHING

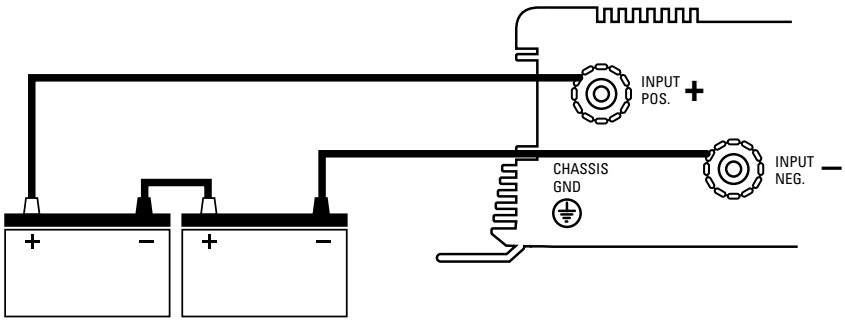
Caution:

- *Even though the inverter is powered from batteries, it still produces Dangerous High Voltage AC power and has the potential to fatally injure if incorrectly installed or used.*
- *Before making any connections ensure inverter is switched off and has no AC appliances plugged into the AC output sockets.*
- *Ensure vehicle / system is a negative earthed or negative ground system only.*
- *Double check battery negative and positive posts before making any connection, a wrong connection (Reverse polarity) will cause the fuse/s to blow and may damage the inverter.*
- *A small spark (Arc) can occur when making the final battery connection, this is most common when the inverter has not been used for some time. This spark is caused by the inverter's large capacitors charging quickly. To minimise this, make the last connection quickly and completely.*
- *Do not make any connections if there are any flammable fumes present or near any volatile fuels.*
- *Batteries can be dangerous, follow all battery manufacturer's instructions and warnings.*
- *Projecta inverters are designed FOR INDEPENDENT USE ONLY. That is, they cannot be connected to household wiring whether the building is connected to the electricity grid or not.*
- *Never operate the inverter without the DC negative input connected direct to the battery and never install a fuse, circuit breaker or battery switch in the negative supply line.*

These inverters can be connected to a power source on a temporary basis with the supplied DC leads (see the section Temporary Connection) or hard wired for a permanent installation with suitably sized cable and hardware for your application (see the section Hard Wired Connection). Regardless of which connection method is used it may be advantageous to earth the inverter case, see the section on External Earthing for more details.

TEMPORARY CONNECTION:

- Connect the ring terminal on the negative lead (Black) to the negative (Black) DC terminal on the back of the inverter.
- Connect the ring terminal on the other end of the lead to the negative DC supply or (-) battery terminal.
- Connect the ring terminal on the positive lead (Red) to the positive (Red) DC terminal on the back of the inverter.
- Connect the ring terminal on the other end of the lead to the positive DC supply or (+) battery terminal.



"HARD WIRED" CONNECTION

When mounting the inverter in a vehicle, caravan, boat, truck or cabin it may be preferable to use longer DC battery cables than those supplied, so that the inverter can be placed in a more convenient, cooler or more protected location.

If longer cables are required only use suitably insulated automotive battery cable according to the following table (Note: B&S = AWG)

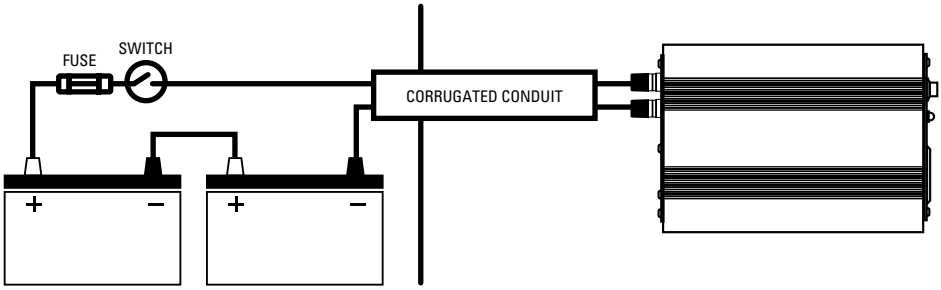
P/No.	IM1000-24	IM2000-24
Up to 2m	6 B&S (14mm2)	3 B&S (26mm2)
3m	3 B&S (26mm2)	2 B&S (32mm2)
4m	2 B&S (32mm2)	0 B&S (49mm2)
6m	0 B&S (49mm2)	00 B&S (64mm2)

• It is recommended that a circuit breaker or high current fuse be placed in the DC positive (+) line close to the batteries.

P/No.	IM1000-24	IM2000-24
Fuse or Circuit Breakers size (+) Only	75AMP	150AMP

• It is recommended that a heavy duty battery switch with a current rating higher than the fuse be fitted in the DC positive (+) line close to the batteries to allow the supply to the inverter to be switched off, this can also be achieved by using a circuit breaker which has a trip facility.

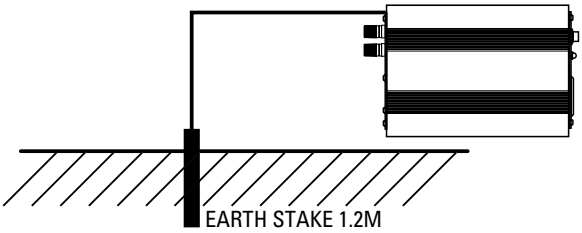
• Positive and Negative cables should be run close together to reduce cable inductance, and be protected from damage by corrugated conduit.



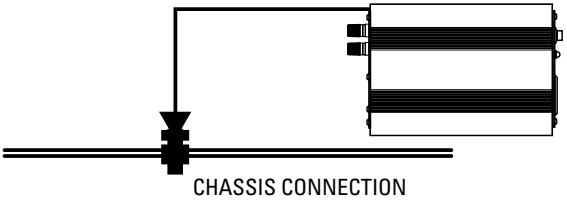
EXTERNAL EARTHING: (OPTIONAL)

Projecta inverters have been internally bonded for safety, by connecting the AC socket/s earth pin to the inverter case and to the DC negative supply input. Because of this most installations do not require the inverter to be earthed. However if the inverter is used in a stationary land based application or if the inverter is causing interference with TV sets or radios it is recommended that an external earth connection is made by one of the following methods:.

• External Earthing Stationary Applications --Connect an earth wire (Preferably solid Green or Green with Yellow stripe) from the external earth connection (Chassis GND) on the rear of the inverter to a metal stake or pipe that is driven into the ground at least 1.2m.



• External Earthing Mobile Applications --Connect an earth wire (Preferably solid Green or Green with Yellow stripe) from the external earth connection (Chassis GND) on the rear of the inverter to the chassis of the vehicle or ground wires in a boat.



OPERATION

Caution:

- *Always switch off the appliance and inverter before recharging the batteries or starting the vehicle engine.*
- *Never connect the AC output of the inverter to normal fixed building wiring or any wiring connected to the mains grid. Normally AC wiring contains a M.E.N. link, this neutral to earth link will damage the inverter.*
- *This inverter is designed for direct connection to appliances however extension leads and power boards can be used.*

PROTECTION FEATURES

Projecta inverters include sophisticated circuitry that monitors the operation of the inverter and turns the inverter off if a problem is detected. The "Fault" light will illuminate and an audible alarm will be heard if this occurs. This prevents damage to the inverter, batteries or appliance being powered.

• Low Battery - This feature will sound a continuous alarm when the batteries powering the inverter are low (21 Volts). It is recommended that the appliance is turned off, then the inverter is also turned off and the batteries are recharged.

If the appliance is allowed to continue to run, the inverter will turn off when the batteries are very low (20.0 Volts) to prevent damage to the batteries or inverter. This will cause a sudden disruption of power to the appliance that may cause problems for some appliances, for example most computers that need to be shut down properly.

• Overload - This feature will sound an alarm and turn the inverter off when the total load connected to the inverter exceeds the inverter's rating (see "Determining suitable load/appliance") This may also occur due to highly inductive loads such as any appliance with a motor causing a sudden peak load on the inverter.

If this occurs, switch "OFF" the appliance and the inverter
After 2 seconds turn the inverter "ON" and the inverter will provide power again. Turn the appliance "ON", if the inverter shuts down more than 3 times, it is likely that the appliance is drawing more load than the inverter can supply, and a larger inverter would be recommended.

• High temperature -This feature will turn the inverter off if the inverter has reached a high temperature. This may occur from continuously running a high load for long periods, due to high ambient temperatures or due to poor ventilation around the inverter. If this occurs, turn the inverter off and allow to cool for at least 15 minutes before resuming operation. Where possible reduce the load on the inverter and improve ventilation.

DETERMINING SUITABLE LOAD / APPLIANCES:

The inverter is fitted with 2 approved AS/NZS Australian socket outlets. Both sockets can be used, as long as the combined load (Watts required to run appliance) does not exceed the inverter's continuous rating and the load connected to one socket does not exceed 2400 Watts (10Amps). All appliances have a rating plate that show the amount of power (Watts) used or the current (Amps) drawn under normal use.

The following table shows the maximum combined AC Watts or AC Amps which can be run by the inverter.

P/No.	IM1000-24	IM2000-24
AC Combined max load (Watts)	1000W	2000W
AC Combined max load (Amps)	4.0 Amps	8.0 Amps

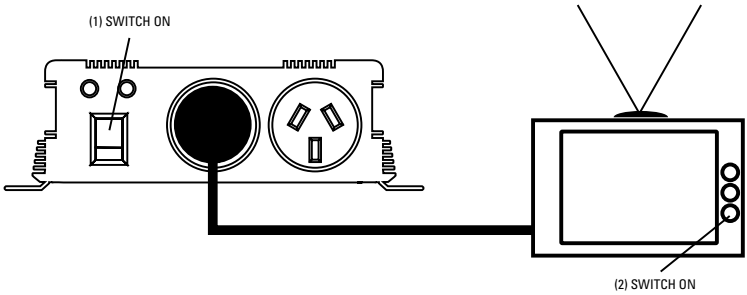
Some appliances that use an electric motor or transformer may draw 2 to 6 times their rating when first turned on, these are called inductive loads and are the most difficult for the inverter to run. For these appliances it is often a matter of trial and error to see what size inverter they will run on, if in doubt always use a larger inverter, use the following table as a guide. The DC Amps column shows the approximate power drawn from the 24 Volt supply.

APPLICATION CHART Appliance			Approximate AC Watts	DC Amps
Circular Power Saw/Electric Chainsaw			2000	87
Toaster/Sandwich Maker			1500	70
Small Household Vacuum Cleaner			1250	47
Belt Sander & other Power Tools			1000	46
Small Microwave Oven (500/600W)*			900	41
Combo TV/VCR			750	34
Power Drill/Portable Grinder			600	25
Flood Lights (500W)			500	23
Submersible Pump*			400	18
Small Colour Television*			350	16
Small Power Tools/Flourescent Light*			300	14
Juicer/Blender			250	11
Bar Fridge*/Large Stereo/PA Amplifier			200	9
Hand Mixer			175	8
Laptop Computer/Electric Knife	IM1000-24	IM2000-24	150	6
Portable Stereo/CD/DVD/VCR/Playstation			100	4
Charger/Mobile Phone/Camera/Camcorder			50	2
Shaver			25	1

*Appliance may require a larger inverter.

CONNECTING APPLIANCE AND RUNNING INVERTER

- Connect the appliance AC plug to the inverter AC outlet socket.
- Switch the inverter "ON", the "Green" power light will illuminate to indicate operation.
- Turn the appliance "ON", if the appliance is fitted with an "On/Off" switch always switch the inverter on before switching the appliance on and always turn the appliance off before switching the inverter off.
- When not in use turn the inverter off.

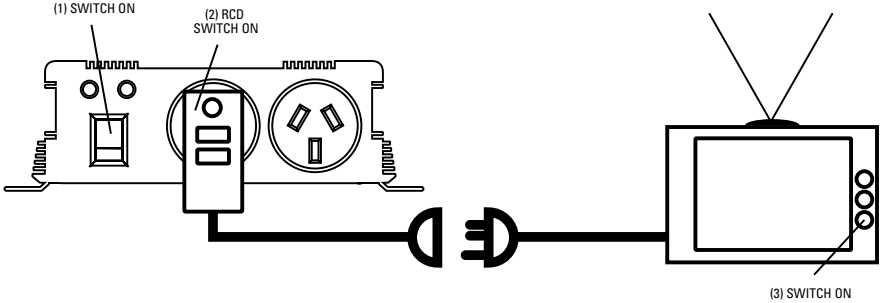


RESIDUAL CURRENT DEVICE (RCD)

For added safety it is recommended that a Type "A" Residual Current Device (RCD) be used for any appliance that is being operated by the inverter. These are sometimes called "Safety Switches" and are designed to be connected between and appliance and power source.

1. Connect the RCD to the inverter AC outlet socket
2. Connect the appliance to the other end of the RCD
3. Turn the inverter "ON"
4. Follow the manufacturer's instructions to turn the RCD "ON" and "TEST" that it is functioning correctly.
5. Turn the appliance on.

Some RCD do not work properly with the inverter's "Modified Wave" output. Check with the RCD manufacturer and always follow the manufacturer's "TEST" procedure to check that the RCD is functioning correctly.



TROUBLESHOOTING / FAQ:

Q. Why does the inverter turn itself off?

A. If the inverter makes a beep sound and the "RED" fault light illuminates this indicates that there is a problem, and the inverter will usually turn off. Most commonly this would be caused by an appliance that is drawing too much power (overloading), low battery voltage or voltage drop due to insufficient size cables or poor connections (see section on protection features, page 9).

Q. The inverter will not run my appliance even though the appliance draws less power (Watts) than the size of the inverter?

A. Electrical appliances can be divided into three groups by the way they draw energy (current) from their power supply. These groups are "Resistive", "Inductive" and "Capacitive" appliances or also called "loads". Some appliances may draw all three types of power.

- Resistive Loads such as normal incandescent lights (wire filament) always draw a constant power (watts) from the power supply, that is a 100 Watt light will draw approximately 100 Watts from the power supply at all times. Resistive loads are the easiest appliances for an inverter to run.
- Inductive Loads such as a refrigerator (Electric Motor) require a large rush of power (surge current) to start and then usually draw a more constant power once running. Inductive loads contain coils of wire (motors, transformers, ballasts, solenoids) When the power is first turned on these coils of wire draw a large surge current which forms the magnetic flux (magnetic field) which allows these appliances to work. This magnetic flux is a kind of stored energy.

- The most common inductive appliances are: fridges, air compressors, transformers / chargers, pumps, power tools and fluorescent lights. These appliances can draw 2 - 6 times their normal running power to start up, that is to run a 190 Watt fridge you may need a 600 or 1000 Watt inverter.

- Capacitive Loads such as many TV's or many electronic appliances require a large surge current to start only when they have not been used for a while. This is often due to large capacitors in the power supply that must be quickly charged when the appliance is turned on. If the appliance is not used for a few days these capacitors slowly go flat. Resetting the inverter a couple of times may allow these appliances to work.
- There are some appliances such as large refrigerators, air conditioners and other pump driven appliances that have extremely high start up currents, because they have an inductive motor that must start under load. These appliances are not recommended for use with an inverter. They should be powered by an engine driven generator.

Q. The inverter is powering my portable television, but I cannot get a clear picture?

A. In poor reception areas it is quite common to have some interference on a portable TV (such as faint lines on the screen) when operating on all modified sine wave inverters.

- To improve your picture quality:
  - Keep the inverter as far away from the TV as possible.
  - Use an external long range or fringe area TV antenna with good quality coaxial cable.
  - Earth (Chassis GND) the inverter (see section on earthing, page 8)

Q. Can I run fluorescent lighting from my inverter?

A. Most portable fluorescent work lamps should operate fine on an inverter even though they may be slow to start.

- Fluorescent lights are an inductive & capacitive load and often draw at least twice as much power from the inverter than their normal rating to start.
- Normal household fluorescent lights should be avoided, because they contain power factor correction capacitors. Power factor correction is used in normal buildings to help smooth out the inductive effects of fluorescent light ballasts. If used with portable power inverters the power factor correction is effected by the harmonic distortion in the modified waveform, this causes a high load on the inverter that can overload the unit. If normal household fluorescent lights must be used, you will need to have a qualified electrician remove the power factor correction capacitor. The light should then be marked "For Inverter Use only".

Q. Why does it damage the inverter if the battery leads are connected back to front?

A. Your inverter uses sophisticated electronics to convert DC battery power to AC mains power. If you accidentally connect the inverter to the batteries incorrectly (reverse polarity) a large current will be drawn by the inverter which will blow the protection fuses, as this occurs some of the high current could damaged sensitive electronic components. Because of this risk it is important to always double-check the batteries polarity before making any connections.

Q. How do I check or change the fuses?

A. The inverter contains internal fuses, these should only be checked or replaced by a qualified electrical appliance repairer.

THE DC SUPPLY MUST BE DISCONNECTED BEFORE ANY REPAIR, THEN TURN THE ON/OFF SWITCH OF THE INVERTER "ON" TO DISCHARGE THE CAPACITORS.

Q. Why do lights operating from the inverter start dim and then get brighter.

A. Projecta inverters feature "Peak Power Technology". This feature allows the inverter to ramp up its voltage output. This gradual increase in power allows appliances to operate with a "Soft-Start" ensuring superior operation and helps the inverter to power inductive loads.

Q. Why does the fan only operate sometimes?

A. These inverters feature a temperature controlled automatic cooling fan, that only operates when needed. This allows the inverter to run very quite for most of the time.

Q. Why does my Residual Current Device (RCD) trip each time I turn an appliance on?

A. Some RCD's disconnect (trip) when they do not receive any power. These types of RCD's can be tripped by the inverters Peak Power Technology which allow a gradual ramp up of power. Use a continuous RCD which does not trip out when the power is turned off, these only trip when there is a fault.

Q. Why do some power tools not work properly?

A. Some newer power tools use PWM variable speed controllers to vary the tool's speed as the trigger is squeezed. These power tools switch the power on and off very quickly in a similar way to how the inverter works. Because of this, some may not function properly with the inverters modified sine wave output.

Q. Can I run laptop computers?

A. Most laptop/notebook computer AC power adapters work perfectly fine with the inverter's modified sine wave. Some however are more sensitive and may not function properly. If your power adaptor does not function or causes a humming noise it is probably not compatible.

Q. Can I connect lights with dimmers to the inverter?

A. Older light dimmers may function fine but most newer light dimming circuits are designed for household sine wave AC power, these may not work properly with modified sine wave inverters.

NOTES:

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